17. Describe the main features of the Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein statistics, including their applications in describing the behavior of particles.

18. Discuss the statistical approach to determining internal energy, entropy, enthalpy, Gibbs function and Helmholtz function.

19. State Onsager's theory. Explain its validity and verification, and the implications of reciprocal relationships in describing irreversible processes.

20. Describe the following:

    (a) Rice-Herzfeld mechanism (5)

    (b) Flash photolysis (5)

NOVEMBER/DECEMBER 2024

23PCH22 — PHYSICAL CHEMISTRY – I

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Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What is mean by activity and activity efficient?

2. Write a brief on the concept of fugacity in the thermodynamics of real gases.

3. How to calculate rotational partition function for mono atomic molecule?

4. Write a note on distinguishable particles.

5. What is the fundamental difference between the Einstein and Debye models for the heat capacity of solids?

6. How is equilibrium constant in chemical reactions related to thermodynamie properties?

7. Give a brief note on the significance of force and flux.

8. Write a note on entropy production in open systems.

9. What are the key factors influencing reaction rates in solution?

10. What is mean by cationic polymerization? Give an example.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Derive the Gibb's-Duhem equation from the fundamental relation for chemical potential.

Or

(b) Explain the determination of activity coefficient using EMF method.

12. (a) Explore the concept of ensembles in statistical thermodynamics, including the canonical ensemble and microcanonical ensemble.

Or

(b) Explain the determination translational and vibrational partition functions for diatomic ideal gases.

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13. (a) Discuss the differences between ortho and para hydrogen in terms of their nuclear spin states and their respective contributions to heat capacity.

Or

(b) Describe the statistical methods used to calculate equilibrium constants and their significance in predicting chemical reaction.

14. (a) Explore the application of irreversible thermodynamics to analyze metabolic pathways in biological systems.

Or

(b) Discuss specific examples of electrokinetic and thermomechanical effects in the irreversible thermodynamics.

15. (a) Briefly describe pressure and temperature jump method for studying fast reactions.

Or

(b) Explain the kinetics of H_2-Cl_2 photochemical reaction.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain the determination of partial molar quantities in detail.